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CORRECTIVE MEASURES STUDY REPORT AREA OF CONCERN 598 AND 599 (AOC 598) (AOC 599) ZONE E CNC CHARLESTON SC

5/30/2003

CH2M HILL

CORRECTIVE MEASURES STUDY REPORT

AOCs 598 and 599, Zone E

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

CH2M-Jones

May 2003

Contract N62467-99-C-0960

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CH2MHILL

May 30, 2003

Mr. David Scaturo
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: CMS Report (Revision 0) – AOCs 598 and 599, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the CMS Report (Revision 0) for AOCs 598 and 599 in Zone E of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Sam Naik. Please contact him at 770/604-9182, ext. 255, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Dann Spariosu/USEPA, w/att
Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

CORRECTIVE MEASURES STUDY REPORT

AOCs 598 and 599, Zone E

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

PREPARED BY
CH2M-Jones

May 2003

Revision 0
Contract N62467-99-C-0960
158814.ZE.PR.15

Certification Page for Corrective Measures Study Report (Revision 0) — AOCs 598 and 599, Zone E

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428

Dean Williamson, P.E.

5/31/2007

Date

Contents

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Acronyms and Abbreviations

AOC	area of concern
BCT	BRAC Cleanup Team
BEQ	benzo[a]pyrene equivalent
BRAC	Base Realignment and Closure Act
CA	corrective action
CMS	Corrective Measures Study
CNC	Charleston Naval Complex
COC	chemical of concern
COPC	chemical of potential concern
CSI	confirmatory sampling investigation
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
ft^2	square feet
HI	Hazard Index
ILCR	incremental lifetime cancer risk
LUC	land use control
LUCIP	land use control Implementation Plan
LUCMP	land use control Management Plan
MCL	maximum contaminant level
MCS	media cleanup standard
mg/kg	milligram per kilogram
NAVBASE	Naval Base
PPE	personal protective equipment
RAO	remedial action objective
RCRA	resource Conservation and Recovery Act
RDA	Redevelopment Authority
RFI	RCRA Facility Investigation
RGO	remedial goal option
SCDHEC	South Carolina Department of Health and Environmental Control

Acronyms and Abbreviations, Continued

SVOC	semivolatile organic compound
VOC	volatile organic compound
yd^3	cubic yards

Section 1.0

1.0 Introduction

In 1993, Naval Base (NAVBASE) Charleston was added to the list of bases scheduled for closure as part of the Defense Base Realignment and Closure Act (BRAC), which regulates closure and transition of property to the community. The Charleston Naval Complex (CNC) was formed as a result of the dis-establishment of the Charleston Naval Shipyard and NAVBASE on April 1, 1996.

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA), with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. All RCRA CA activities are performed in accordance with the Final Permit (Permit No. SC0 170 022 560). In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC.

A RCRA Facility Investigation (RFI) Report Addendum and Corrective Measures Study (CMS) Work Plan were prepared for Areas of Concern (AOCs) 598 and 599 in Zone E of the CNC (CH2M-Jones, 2003). The RFI Report Addendum and CMS Work Plan presented the remedial action objectives (RAOs) and media cleanup standards (MCSs) proposed for AOCs 598 and 599. This CMS report has been prepared by CH2M-Jones to complete the next stage of the CA process for AOCs 598 and 599.

1.1 Corrective Measures Study Report Purpose and Scope

This CMS report evaluates corrective measure (remedial) alternatives for preventing unacceptable exposure to benzo[a]pyrene equivalent (BEQ) contamination found in the soil at AOCs 598 and 599. BEQs in surface soil are the chemicals of concern (COCs) identified at these two AOCs under the unrestricted (i.e., residential) use and industrial land use scenarios. Figure 1-1 illustrates the original location of AOCs 598 and 599 within Zone E. Figure 1-2 is an aerial photograph showing the layout of AOCs 598 and 599.

This CMS report consists of: 1) the identification of a set of corrective measure alternatives that are considered to be technically appropriate for addressing COC-contaminated soil; 2) an evaluation of the alternatives using standard criteria from U.S. Environmental Protection Agency (EPA) RCRA guidance; and 3) the selection of a recommended (preferred) corrective measure alternative for the site.

This focused CMS evaluates the options for meeting the RAOs, which are described in Section 2.0 of this report. The two remedies considered for achieving the RAOs are: 1) soil excavation and offsite disposal, and 2) land use controls (LUCs). The remedial activities associated with soil removal include excavation, backfilling, (replacing) pavement, and offsite disposal. The remedial activities that are associated with the LUCs include maintaining the existing site use (commercial/industrial) and site controls (pavement/building); a LUC Management Plan (LUCMP) agreement between the Navy and the State of South Carolina; and long-term monitoring and review.

1.2 Background Information

This section of the CMS report presents background information on the facility, site history, and a summary of the nature and extent of the COCs at the site. This information is important for the understanding of the remedial goal options (RGOs), MCSs, and ultimately the evaluation of corrective measure alternatives for AOCs 598 and 599. Additional information on the site and hydrogeology in the Zone E area of the CNC is provided in the *Zone E RFI Report, Revision 0* (EnSafe Inc. [EnSafe], 1997).

1.2.1 Facility Description and Site History

AOC 598 is a former sonar dome repair area adjacent to Pier J at the CNC. It consisted of a temporary metal building on asphalt pavement. Several storm drains are located in the vicinity. The area was used to clean and repaint sonar domes and to remove adhesives. The repair work occurred both inside and outside of the building. Currently the area is used by a boat maintenance and repair shop for cleaning and repairing boats.

AOC 599 is a former pump house on Pier J. The pump house was damaged by hurricane Hugo in 1989. Since that time, rainwater has collected in the below-grade structure. The pump house was formerly a transfer station for diesel fuel.

This area of Zone E is zoned for M-2 (marine industrial) land use. The CNC RCRA Permit identified AOCs 598 and 599 as requiring a Corrective Study Investigation (CSI).

The materials of concern identified in the *Final Zone E RCRA Facility Investigation Work Plan, Revision 1* (EnSafe/Allen & Hoshall, 1995) based on historical operations at AOCs 598 and 599 include solvents, degreasers, explosives, propellants, and petroleum hydrocarbons.

Regulatory review was conducted on the *Zone E RFI Report, Revision 0* (EnSafe, 1997), and a draft responses to comments from SCDHEC was prepared by the Navy/EnSafe team. The subsequent *RFI Report Addendum and CMS Work Plan for AOCs 598 and 599, Zone E,*

Revision 1 (CH2M-Jones, 2003) prepared by CH2M-Jones identified BEQs as COCs in surface soil at AOCs 598 and 599. Detailed information on the analytical results and the screening of those results to determine the COCs can be found in the RFI report for Zone E and the RFI Report Addendum and CMS Work Plan for AOCs 598 and 599.

1.2.2 Soil COC Summary

Two soil sampling events were conducted at AOCs 598 and 599 during the RFI. The locations of the sampling events are shown on Figure 1-3. Soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals.

The RFI report identified the following COCs for surface soil:

- Unrestricted (i.e., residential) – BEQs and lead, and
- Commercial/Industrial – BEQs and lead.

No COCs were identified in subsurface soils during the initial RFI.

1.2.3 Groundwater COC Summary

The RFI report identified the following COCs for groundwater at AOCs 598 and 599:

Shallow Groundwater

- Although the RFI report indicated that heptachlor epoxide should be retained as a shallow groundwater COC, heptachlor epoxide was not detected above detection limits in the groundwater. The RFI appears to have incorrectly reported heptachlor epoxide as a COC, rather than heptachlor. Heptachlor is discussed in Section 5.0 of the RFI Report Addendum and was not identified as a COC in groundwater at AOCs 598 and 599.

Deep Groundwater

- No deep groundwater COCs were identified during the initial RFI.

After evaluating contaminants of potential concern (COPCs), *the RFI Report Addendum and CMS Work Plan, Revision 1* (CH2M-Jones, 2003) identified only BEQs in surface soil as COCs under the unrestricted (i.e., residential) and industrial land use scenarios. No other COCs were identified in soils or groundwater. This CMS focuses on BEQs in surface soil at AOCs 598 and 599.

1.3 Report Organization

This CMS report consists of the following sections, including this introductory section:

1.0 Introduction — Presents the purpose of and background information relating to this CMS report.

2.0 Remedial Goal Options and Proposed Media Cleanup Standards— Defines the RGOs and proposed MCSs for AOCs 598 and 599, in addition to the criteria used in evaluating the corrective measure alternatives for the site.

3.0 Overall Approach for Evaluating Focused Alternatives for AOCs 598 and 599 — Describes the alternative development process and presents the detailed evaluation criteria.

4.0 Description of Candidate Corrective Measure Alternatives — Describes each of the candidate corrective measure alternatives for addressing BEQs in soil.

5.0 Evaluation and Comparison of Corrective Measure Alternatives — Evaluates each alternative relative to standard criteria, then compares the alternatives and the degree to which they meet or achieve the evaluation criteria.

6.0 Recommended Corrective Measure Alternative — Describes the preferred corrective measure alternative to achieve the MCS and RGOs for BEQs in soil based on a comparison of the alternatives.

7.0 References— Lists the references used in this document.

Appendix A contains cost estimates developed for the proposed corrective measure alternatives.

All tables and figures appear at the end of their respective sections.

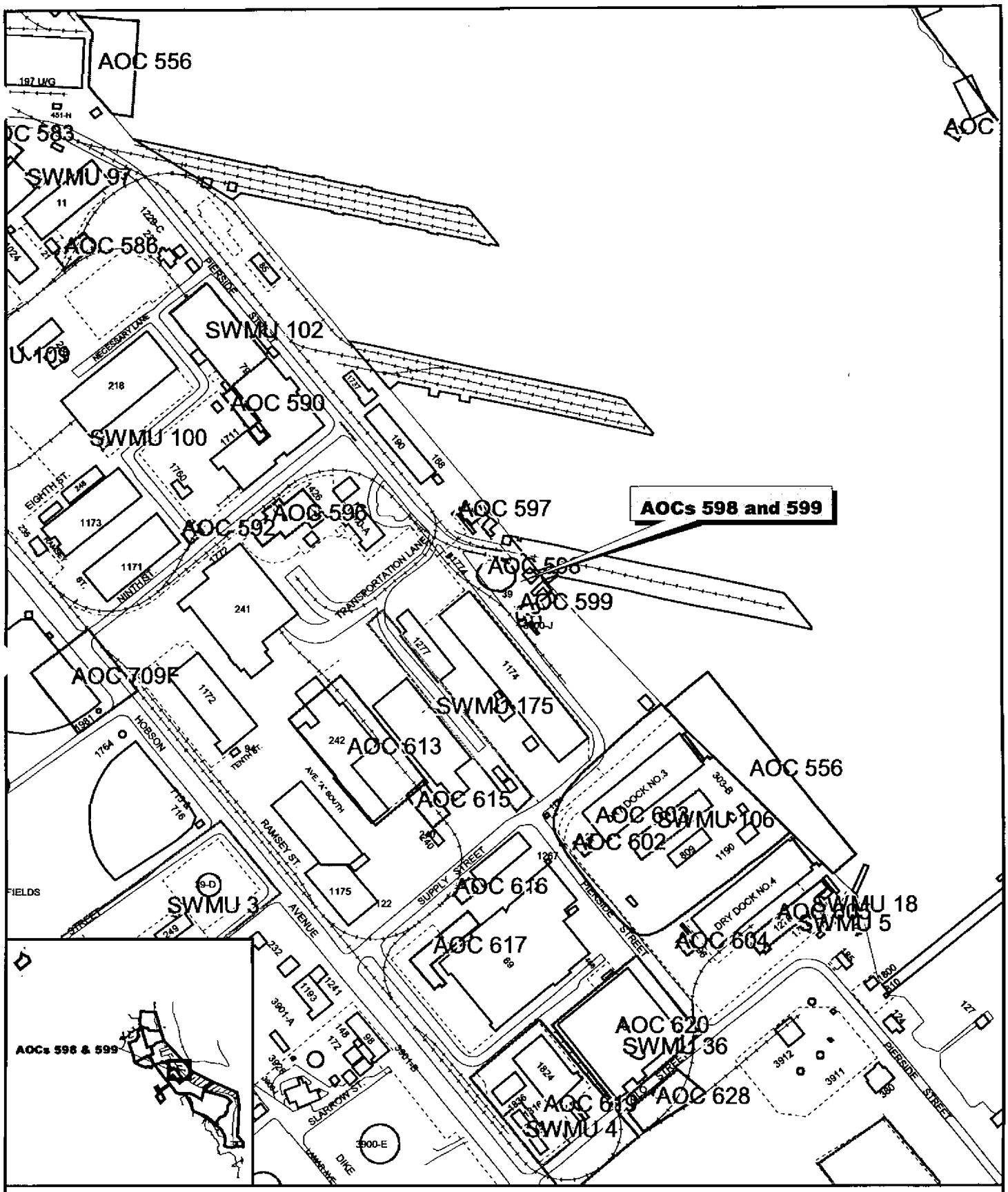

Figure 1-1
Location of AOCs 598 and 599 within Zone E
Charleston Naval Complex

N

0 300 600 Feet

1 inch = 360 feet

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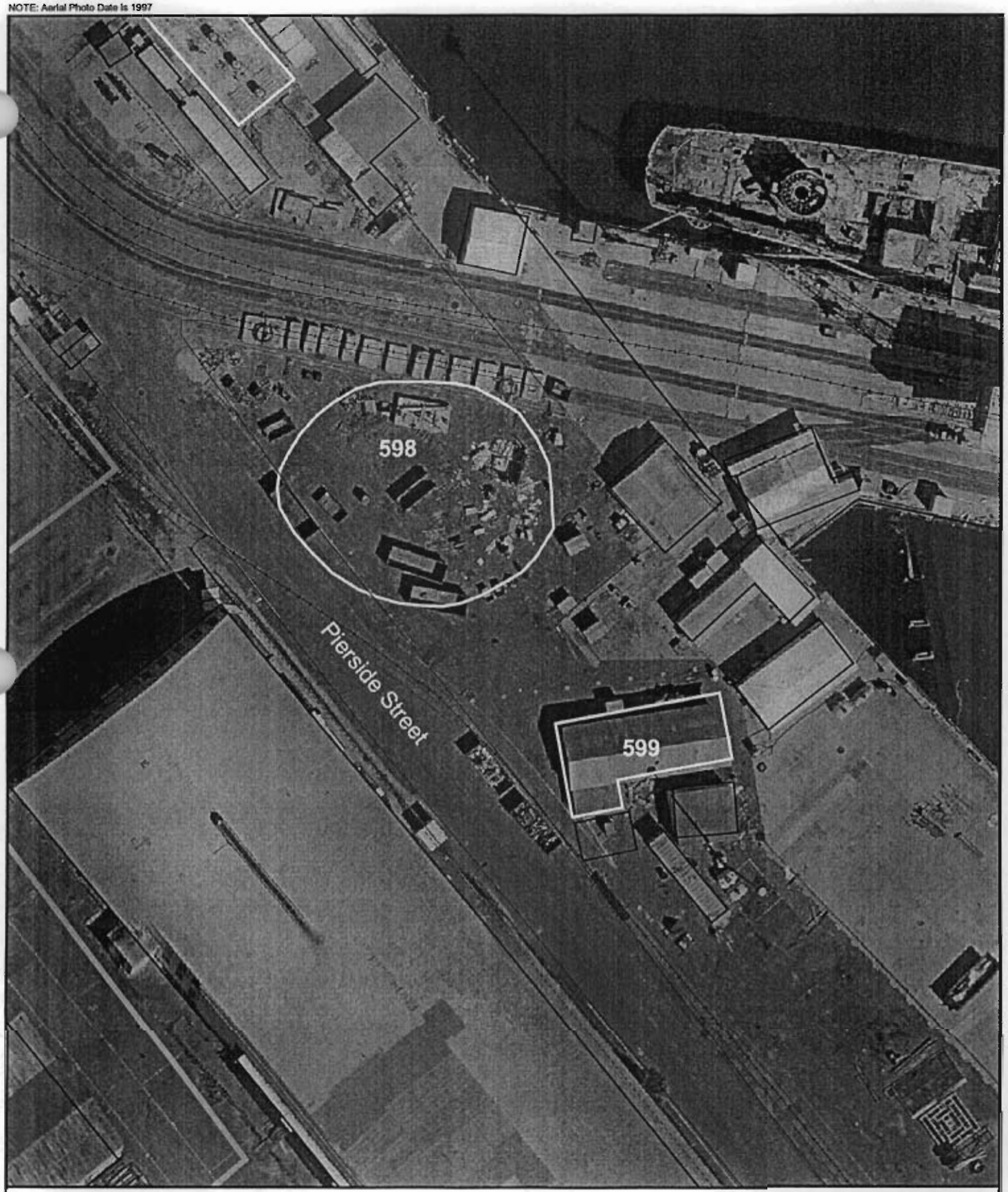
NOTE: Aerial Photo Date is 1997



Fence
Railroads
Roads
Shoreline
AOC Boundary
Buildings
Zone Boundary

N

0 40 80 Feet

1 inch = 50 feet

Figure 1-2
Site Map
AOC 598 and AOC 599, Zone E
Charleston Naval Complex

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File Path: c:\18gis\projects\zone_e\aoc598aoc599\apr\598_599.apr, Date: 10 Dec 2001 10:07, User: NMOUDRY, Figure 1-2 Site Map

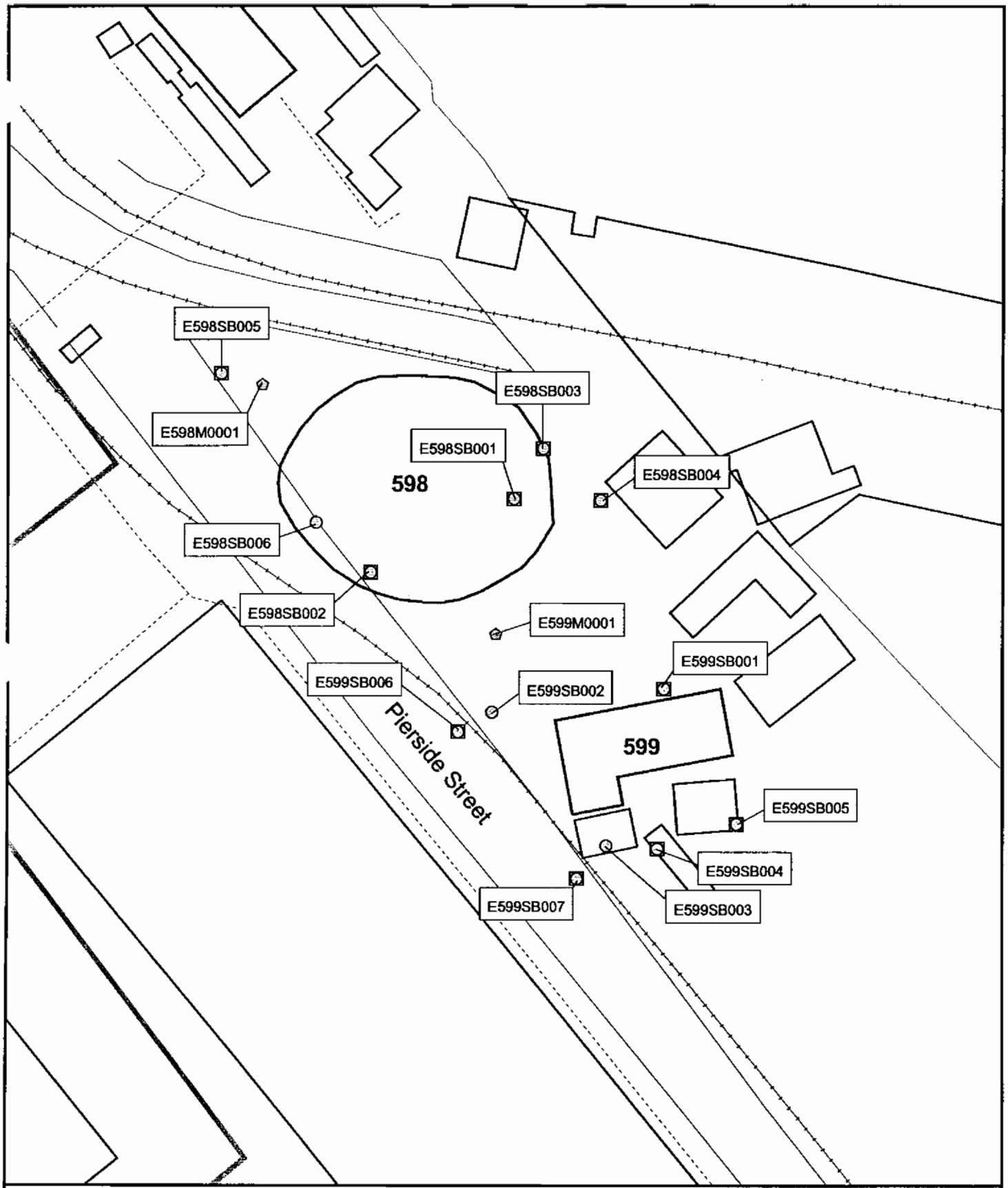

Figure 1-3
Historical Soil and Sediment Sample Location Map
AOC 598 and AOC 599, Zone E
Charleston Naval Complex

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File Path: c:\18gis\projects\zone_e\aoc598aoc599\apr\598_599.apr, Date: 10 Dec 2001 10:38, User: NMOUDRY, Figure 2-1 Historical Soil and Sediment Sample Location Map

Section 2.0

2.0 Remedial Goal Options and Proposed Media Cleanup Standards

RGOs and MCSs are typically developed at the end of the risk assessment in the RFI. RGOs can be based on a variety of criteria, such as drinking water maximum contaminant levels (MCLs), specific incremental lifetime cancer risk (ILCR) target levels (e.g., 1E-04, 1E-05, or 1E-06), target Hazard Index (HI) levels (e.g., 0.1, 1.0, 3.0), or site background concentrations. When site background concentrations are higher than the health protection-based concentrations, the background levels are the target MCSs. Achieving these goals should protect human health and the environment, while achieving compliance with applicable state and federal standards.

2.1 Remedial Action Objectives

RAOs are medium-specific goals that protect human health and the environment by preventing or reducing exposures under current and future land use conditions. In the *RFI Report Addendum for AOCs 598 and 599, Revision 0,* (CH2M-Jones, 2002), the RAO for surface soil is to prevent ingestion and direct/dermal contact with soil containing COCs at unacceptable levels.

2.2 Media Cleanup Standards

MCSs for AOCs 598 and 599 were presented in the *RFI Report Addendum and CMS Work Plan, Revision 1* (CH2M-Jones, 2003). The CNC BEQ sitewide reference concentration of 1.304 milligrams per kilogram (mg/kg) developed by the BRAC Cleanup Team (BCT) was recommended in the CMS Work Plan for AOCs 598 and 599 as the MCS for BEQs in surface soil.

The MCS will be met if the site statistical estimates of concentrations are similar to background statistical estimates. For point comparisons between site and background, the ranges of site concentrations may be compared with the ranges of Zone E background concentrations. Other potential RGOs, such as the 1E-06 ILCR level, were considered but regarded as not applicable because the CNC background concentrations of BEQs are greater than this level.

The pattern of distribution of BEQs in surface soil at this site indicates three areas of exceedances above the CNC BEQ sitewide reference concentration of 1.304 mg/kg. These areas are RFI soil boring locations E598SB002, E598SB006 and E599SB007, where surface soil BEQ concentrations of 7.09 mg/kg, 1.39 mg/kg, and 24.92 mg/kg, respectively, were detected during the initial RFI. These locations are shown on Figure 1-3.

The focus of this CMS is to evaluate alternatives that will achieve the RAOs described above. The corrective measure alternatives evaluated include:

- Alternative 1: Soil removal and offsite disposal with LUCs, and
- Alternative 2: LUCs.

These alternatives are discussed in Section 4.0 of this CMS report.

Section 3.0

3.0 Overall Approach for Evaluating Focused Alternatives for AOCs 598 and 599

3.1 Preferred Remedies

A variety of corrective measure approaches are conceptually feasible for BEQs in soil at AOCs 598 and 599. However, remedy selection at the CNC has focused on a few demonstrated technologies. For contaminants in soil that are limited in area, the preferred technologies that are expected to be effective at the CNC include: 1) soil excavation and offsite disposal with LUCs, and 2) LUCs. Generally, at sites similar to AOCs 598 and 599 with limited soil contamination, a preference exists for implementing one of these remedies to expedite the remedy selection and implementation processes, improve predictability of the remedy, and lower costs. These candidate alternatives are screened and evaluated using the conventional criteria presented below.

In this focused CMS, these two alternatives will be described (Section 4.0), evaluated in detail (Section 5.0), and one will be proposed as a recommended alternative (Section 6.0).

3.2 Evaluation Criteria

According to the EPA RCRA CA guidance, corrective measure alternatives should be evaluated using the following five criteria:

1. Protection of human health and the environment.
2. Attainment of MCSs.
3. The control of the source of releases to minimize future releases that may pose a threat to human health and the environment.
4. Compliance with applicable standards for the management of wastes generated by remedial activities.
5. Other factors, including (a) long-term reliability and effectiveness; (b) reduction in toxicity, mobility, or volume of wastes; (c) short-term effectiveness; (d) implementability; and (e) cost.

Each of these criteria is defined in more detail below.

1. **Protection of human health and the environment.** The alternatives will be evaluated on the basis of their ability to protect human health and the environment. The ability of an alternative to achieve this criterion may or may not be independent of its ability to achieve the other criteria. For example, an alternative may be protective of human health, but may not be able to attain the MCSs if the MCSs were not developed based on human health protection factors.

2. **Attainment of MCSs.** The alternatives will be evaluated on the basis of their ability to achieve the MCS defined in this CMS. Another aspect of this criterion is the time frame required to achieve the MCS. Estimates of the time frame for the alternatives to achieve RGOs will be provided.

3. **The control of the source of releases.** This criterion deals with the control of releases of contamination from the source (the area in which the contamination originated) and the prevention of future migration to uncontaminated areas.

4. **Compliance with applicable standards for management of wastes.** This criterion deals with the management of wastes derived from implementing the alternatives (i.e., treatment or disposal of contaminated soil removed from excavations). Corrective measure alternatives will be designed to comply with all standards for management of wastes. Consequently, this criterion will not be explicitly included in the detailed evaluation presented in the CMS, but such compliance would be incorporated into the cost estimates for which this criterion is relevant.

5. **Other factors.** Five other factors are to be considered if an alternative is found to meet the four criteria described above. These other factors are as follows:

    a. Long-term reliability and effectiveness

    Corrective measure alternatives will be evaluated on the basis of their reliability, and the potential impact should the alternative fail. In other words, a qualitative assessment will be made as to the chance of the alternative's failing and the consequences of that failure.

    b. Reduction in the toxicity, mobility, or volume of wastes

    Alternatives with technologies that reduce the toxicity, mobility, or volume of the contamination will be generally favored over those that do not. Consequently, a qualitative assessment of this factor will be performed for each alternative.

c. Short-term effectiveness

Alternatives will be evaluated on the basis of the risk they create during the implementation of the remedy. Factors that may be considered include fire, explosion, and exposure of workers to hazardous substances.

d. Implementability

The alternatives will be evaluated for their implementability by considering any difficulties associated with conducting the alternatives (such as the construction disturbances they may create), operation of the alternatives, and the availability of equipment and resources to implement the technologies comprising the alternatives.

e. Cost

A net present value of each alternative will be developed. These cost estimates will be used for the relative evaluation of the alternatives, not to bid or budget the work. The estimates will be based on information available at the time of the CMS and on a conceptual design of the alternative. They will be "order-of-magnitude" estimates with a generally expected accuracy of -50 percent to +100 percent for the scope of action described for each alternative. The estimates will be categorized into capital costs and operations and maintenance costs for each alternative.

Section 4.0

4.0 Description of Candidate Corrective Measure Alternatives

4.1 General Description of Alternatives

Two candidate corrective measure alternatives were selected for AOCs 598 and 599:

- Alternative 1: Soil Excavation and Offsite Disposal with LUCs
- Alternative 2: LUCs

The implementation of Alternative 1 would involve the removal of soil at locations where BEQ concentrations exceed the MCS. Based on an evaluation of BEQs, three areas at the site that are under asphalt pavement will require surface soil removal in order for site soils to meet the BEQ MCS:

- RFI soil boring locations E598SB002, E598SB006 and E599SB009.

The approximate area of soil needing removal to achieve the MCS for Alternative 1 is shown on Figure 4-1. A 20-percent scope contingency is assumed and included in the cost for this alternative.

For Alternative 2, it is assumed that the LUCs will include the following administrative controls:

- Restrictions limiting the property land use to non-residential uses.
- Restrictions to maintain the extent of paved area, unless a demonstration is made that changing a currently paved area to unpaved status will not cause a failure to meet one of the RAOs.

The sections below describe each alternative in detail.

4.2 Alternative 1: Soil Excavation and Offsite Disposal

4.2.1 Description of Alternative

This alternative will remove contaminated soil in the areas shown on Figure 4-1 that exceed the MCS established in Section 2.0.

Excavated soil would be transported to a permitted landfill facility for long-term disposal, and the excavation would be filled with clean backfill from an offsite borrow source. Once the soil is removed, the site would be acceptable for unrestricted land use, with no long-term monitoring required. However, because the site is located in Zone E, LUCs will continue to be applied at this site in the same manner as the other sites within the zone. These LUCs are expected to include restricting the property to non-residential activities.

At each excavation location, the area of asphalt pavement to be removed is approximately 10 feet by 10 feet, for a total excavated area of 300 square feet (ft^2). The removal and replacement of this asphalt is required in order to access all of the surface soil proposed for removal. At each location, the asphalt pavement is assumed to be about 1-foot thick, with an approximate total volume from all three locations of 11 cubic yards (yd^3). Assuming an average depth of soil excavation of 1 foot below the asphalt pavement, the total in-place volume of soil to be removed from this area is approximately 11 yd^3. An equal amount of clean backfill will be required to fill in the excavated areas and enough asphalt to replace the impacted pavement. Confirmation sampling would involve 5 samples (4 sidewall samples and 1 bottom sample) at each location, for a total of 15 samples, plus 2 additional QA/QC samples.

4.2.2 Other Considerations

Coordination with the CNC Redevelopment Authority (RDA) would be required for site restrictions during excavation and traffic control for the haul trucks.

At the E599SB007 location, partial removal and replacement of the railroad track may be necessary, which will require coordination with the RDA and other agencies that have jurisdiction over the railroad lines running through CNC.

The potential for expansion of scope during confirmation testing is moderate. Based on the above factors, a 20-percent scope contingency is assumed.

4.3 Alternative 2: Land Use Controls

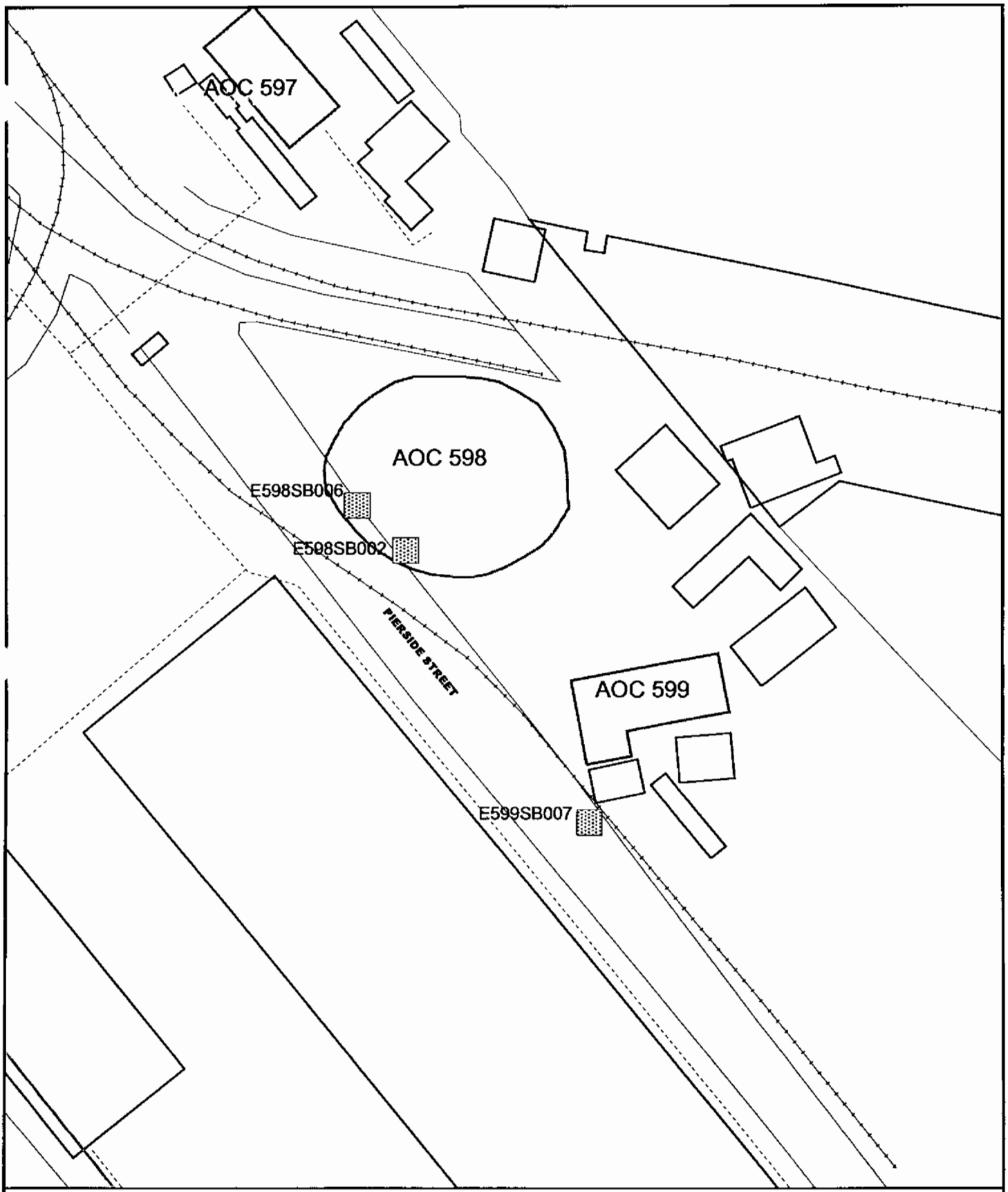
4.3.1 Description of Alternative

This alternative involves leaving the contaminated soil (and co-located overlying pavement and railroad lines) in place and instituting administrative/legal controls to restrict future land use. The controls would limit land use to activities that present less frequent exposure by sensitive populations to surface soil and preclude uncontrolled disturbance to the contaminated soil, thereby minimizing the potential for human exposure to the

contamination. The addition of restrictions on soil disturbance and site occupancy would minimize potential for human exposure that could occur in a residential or industrial setting. The controls may be in the form of deed restrictions and/or easements (property interests retained by the Navy during property transfer to assure protectiveness of the remedy). Periodic monitoring would be required to assure controls are maintained; periodic site inspections would be required to assure compliance with institutional controls. Controls may be layered (multiple controls at the same time) to enhance protectiveness. The Navy is negotiating a comprehensive Land Use Control Implementation Plan (LUCIP) for the CNC.

4.3.2 Other Considerations

Currently, the Navy is the property owner and land use in Zone E of the CNC is restricted to non-residential use. Existing engineering controls include pavement and structures that prevent or limit access to contaminated soil. The location and proximity of the site to other industrial properties make residential use highly unlikely. Periodic monitoring of the deed controls and the site would be required. For the purpose of developing a representative cost estimate for this process, an annual evaluation that would include a site inspection is assumed.



10 ft x 10 ft Excavation Area
Railroads
Roads - Lines
AOC Boundary
SWMU Boundary

N

0 40 80 Feet

1 inch = 56 feet

Figure 4-1
Excavation Locations, CMS Alternative 1
AOCs 598 and 599
Charleston Naval Complex

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Section 5.0

5.0 Evaluation and Comparison of Corrective Measure Alternatives

The corrective measure alternatives were evaluated relative to the criteria previously described in Section 2.0, and then subjected to a comparative evaluation. A cost estimate for each alternative was also developed; the assumptions and unit costs used for these estimates are included in Appendix A.

5.1 Alternative 1: Soil Excavation and Offsite Disposal

The following assumptions were made for Alternative 1:

- Three areas would be targeted for soil excavation, as shown on Figure 4-1.
- A total of 11.1 yd^3 of soil (in-place measurement) would be excavated for offsite disposal at a Subtitle D facility and replaced with clean backfill.
- Approximately 300 ft^2 of concrete flooring would be removed/replaced and approximately 11.1 yd^3 of asphalt pavement (in-place measurement) would be removed/replaced.
- Approximately 20 feet of railroad line would have to be removed and reset in place near soil boring location E599SB007.
- Excavations would include known exceedances plus extrapolated areas to account for uncertainty.
- Confirmation testing will validate that the extent of contaminated soil is limited to that shown on Figure 4-1, plus a maximum contingency of 20 percent.

5.1.1 Protection of Human Health and the Environment

This alternative is effective at protecting human health and the environment because it removes soil with BEQ concentrations that exceed the MCS from the site. The replacement soil will have concentrations of BEQs below the MCS.

5.1.2 Attain Media Cleanup Standard

This alternative will permanently remove soil with BEQ concentrations that exceed the MCS. The MCS will be achieved at the completion of soil removal actions.

5.1.3 Control the Source of Releases

There are no ongoing sources of releases at AOCs 598 and 599; therefore, this issue is not applicable.

5.1.4 Compliance with Applicable Standards for the Management of Generated Wastes

Excavated soil will be sampled and analyzed for waste characterization prior to disposal. Soil, decontamination waste, and personal protective equipment (PPE) will be disposed of in accordance with applicable regulations and permits. Offsite transportation and disposal will be performed by properly permitted and licensed subcontractors.

5.1.5 Other Factors (a) Long-term Reliability and Effectiveness

This alternative would have long-term reliability and be effective for the site as long as all exceedances are removed. The removal of contamination from the site would be permanent. Uncertainty in the distribution of BEQs in soil is addressed by expanding the excavations beyond the RFI delineation, thus reducing the risk of failure of this alternative. Confirmation sampling would confirm that the excavations have removed soil exceedances. It is much less likely that any significant amount of soil with BEQ concentrations above the MCS will be left in place; sitewide average concentrations will be below the MCS for the unrestricted land use scenario.

5.1.6 Other Factors (b) Reduction in the Toxicity, Mobility, or Volume of Wastes

Alternative 1 reduces the mobility of the contaminated soil by transporting it to a regulated containment facility (landfill). Treatment will not be required unless the soil exhibits toxicity characteristics per 40 Code of Federal Regulations (CFR) 261.24. If required, soil will be treated at the disposal facility to further reduce the mobility of the BEQs.

5.1.7 Other Factors (c) Short-term Effectiveness

The excavation and hauling of contaminated soil in this alternative has the potential to create dust containing contaminated soil particles. However, standard engineering controls such as dust suppression during excavation, tarp covers on trucks, and worker PPE to prevent dust inhalation will be implemented. Thus, with controls, the alternative provides short-term effectiveness in preventing ingestion of, or contact with, the contaminated soil and minimizes the potential for migration of soil particles. The technologies for dust control and worker protection are well-established and robust. No unmanageable hazards would be created during implementation.

5.1.8 Other Factors (d) Implementability

This alternative will be moderately difficult to implement. Most of the required activities have been routinely implemented at nearby sites using standard equipment and procedures. Utility clearance, subcontracting, waste characterization, and base approval are customary activities. The field implementation of this remedy is estimated to require 4 to 6 weeks, and the benefits will be immediate. There is ample offsite capacity for disposal (and treatment, if required) of the contaminated soil.

5.1.9 Other Factors (e) Cost

Appendix A presents the overall cost estimate for implementing this remedy. These costs reflect soil removal based on available RFI sample results, plus removal and replacement of concrete flooring. A scope contingency of 20 percent is added to cover minor additional excavation that may be required per results of confirmation testing. In summary, the costs include the following:

- Remove soil in areas at each occurrence of MCS exceedance.
- Perform confirmation tests in each area to confirm compliance with MCS.
- Apply 20 percent contingency for additional scope that may be required based on compliance tests.
- Apply 20 percent contingency for additional scope that may be required based on removal and replacement of railroad lines at E599SB007.

Using the assumptions listed above, the total present value of Alternative 1 is $62,000.

5.2 Alternative 2: Land Use Controls

The assumptions for Alternative 2 include the following:

- A base-wide LUCIP will be developed for the CNC. The plan will allow for restrictions on land use at AOCs 598 and 599 and other areas, and will be developed outside the scope of this CMS.
- Periodic monitoring will be performed for 30 years. The monitoring will consist of an annual site visit to confirm that site use(s) are consistent with the LUCIP. Although the present worth costs have been calculated for a 30-year period of monitoring, it is assumed that LUCs could be in place for as long as required. The present worth costs for

a longer period of monitoring are not significantly different from those for a 30-year period of monitoring.

5.2.1 Protection of Human Health and the Environment

This alternative will effectively protect human health because it restricts future uses that would be inappropriate for the MCS exceedances at the site.

5.2.2 Attain Media Cleanup Standard

This alternative would not achieve the MCS for BEQs.

5.2.3 Control the Source of Releases

There are no ongoing sources of releases at AOCs 598 and 599; therefore, this issue is not applicable.

5.2.4 Compliance with Applicable Standards for the Management of Generated Wastes

Alternative 2 does not generate any wastes that would require special management.

5.2.5 Other Factors (a) Long-term Reliability and Effectiveness

This alternative provides a level of protection that has long-term reliability and effectiveness. The risk of failure is low, provided the LUCIP is enforced by the responsible entity. If LUCs were not enforced, unpermitted use of the site may result in human exposure to BEQs above the MCS.

5.2.6 Other Factors (b) Reduction in the Toxicity, Mobility, or Volume of Wastes

This alternative involves no treatment and does not reduce the toxicity, mobility, or volume of contaminated soil at AOCs 598 and 599.

5.2.7 Other Factors (c) Short-term Effectiveness

The Navy retains ownership and control of the site use until LUCs are implemented. This alternative does not involve any site activities, so no short-term risks are created.

5.2.8 Other Factors (d) Implementability

Alternative 2 is relatively easy to implement since it requires only the development of LUCs and an appropriate monitoring program.

5.2.9 Other Factors (e) Cost

Alternative 2 is not costly to implement since it requires no construction of treatment facilities or disposal of wastes. The cost for this alternative is for administrative/legal

services and periodic monitoring and/or review for 30 years. Although the present worth costs have been calculated for a 30-year period of monitoring, it is assumed that LUCs could be in place for as long as required. The present worth costs for a longer period of monitoring are not significantly different from those for a 30-year period of monitoring. Longer monitoring would likely be required, but its cost impact to present value of this alternative is minimal.

Using the assumptions described earlier, the total present value of Alternative 2 is $20,000.

5.3 Comparative Ranking of Corrective Measure Alternatives

The overall ability of each corrective measure alternative to meet the evaluation criteria is described above. Table 5-1 presents a comparative evaluation of the degree to which each alternative meets a particular criteria. Alternative 2: LUCs is the preferred alternative. It provides a protective and reliable remedy at a lower cost than Alternative 1.

TABLE 5-1
Qualitative Comparison of Corrective Measure Alternatives
Corrective Measures Study Report, AOCs 598 and 599, Zone E, Charleston Naval Complex

Criterion	Alternative 1 Soil Excavation and Offsite Disposal with Land Use Controls	Alternative 2 Land Use Controls
Overall Protection of Human Health and the Environment	Protects human health and the environment	Protects human health and the environment
Attainment of MCS	Would achieve MCS	Would not achieve MCS
Control of the source of releases	N/A	N/A
Compliance with applicable standards for the management of wastes	Complies with applicable standards	Complies with applicable standards
Long-term Reliability and Effectiveness	Reliable and effective long term	Reliable and effective long term, provided periodic inspections are performed
Reduction of Toxicity, Mobility, or Volume through Treatment	Reduces mobility via placement of soil in landfill	Does not reduce toxicity, mobility, or volume
Short-term Effectiveness	Effective in short term	Effective in short term
Implementability	Moderately difficult to implement due to need to remove/replace concrete and asphalt pavement and work in busy industrial area.	Easy to implement
Cost Ranking	Moderately Expensive	Inexpensive
Estimated Cost	$62,000	$20,000

Section 6.0

6.0 Recommended Corrective Measure Alternative

Two corrective measure alternatives were evaluated using the criteria described in Section 2.0 of this CMS report:

- Alternative 1: Soil Excavation and Offsite Disposal with LUCs, and
- Alternative 2: LUCs.

The preferred corrective measure alternative is Alternative 2: LUCs. The remedy would be protective at a moderate cost.

Alternative 2 would provide protection of human health and the environment by maintaining the current and planned future use of the site as industrial/commercial. Limitations would prevent residential and other unrestricted land use that could expose sensitive populations.

Engineering controls to minimize future releases are already in place. Most of the area is paved or covered by a structure. Planning is already underway to develop and implement administrative controls that would limit future site activities to those that would not involve unrestricted exposures. The expected reliability of this alternative is good.

There are no community safety issues associated with implementation of this remedy, and the controls would be relatively easy to implement. This alternative provides long-term effectiveness for the planned industrial/commercial use and relies on administrative controls to prevent future residential use.

Section 7.0

7.0 References

CH2M-Jones. *RFI Report Addendum for AOCs 598 and 599, Zone E, Revision 0.* October 2002.

CH2M-Jones. *RFI Report Addendum and CMS Work Plan for AOCs 598 and 599, Zone E, Revision 1.* March 2003.

EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, NAVBASE Charleston.* June 6, 1995.

EnSafe Inc. *Zone E RFI Report, Revision 0.* NAVBASE Charleston. November 1997.

Appendix A

COMPARISON OF TOTAL COST OF REMEDIAL SOLUTIONS

Site:	Charleston Naval Complex	**Base Year:**	2002
Location:	AOCs 598 and 599	**Date:**	05/22/03
Phase:	Corrective Measures Study		

	Alternative Number 1	Alternative Number 2
Total Project Duration (Years)	<1	30
Capital Cost	$42,000	$6,000
Annual O&M Cost	$0	$1,100
Total Present Value of Solution	$62,000	$20,000

Disclaimer: The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This is an order-of-magnitude cost estimate that is expected to be within -50 to +100 percent of the actual project costs.

Alternative: Number 1 — **COST ESTIMATE SUMMARY**

Elements: Soil Excavation and Offsite Disposal

Site: Charleston Naval Complex

Location: AOCs 598 and 599

Phase: Corrective Measures Study

Base Year: 2002

Date: 05/22/03

Description: Excavation of contaminated soil, disposal offsite at permitted landfill, backfill with clean soil. Extent includes RFI sample points plus 20% scope contingency.

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Confirmation Sampling	1	EA	$3,500	$3,500	See Confirmation Worksheet
Removal, Disposal and Backfill	1	EA	$23,000	$23,000	See Excavation 1 Worksheet
				$0	
SUBTOTAL				$26,500	
Contingency	20%		$26,500	$5,300	
SUBTOTAL				**$31,800**	
Project Management	8%		$31,800	$2,544	USEPA 2000, p. 5-13, $100K-$500K
Remedial Design	15%		$31,800	$4,770	USEPA 2000, p. 5-13, $100K-$500K
Construction Management	10%		$31,800	$3,180	USEPA 2000, p. 5-13, $100K-$500K
SUBTOTAL				**$10,494**	
TOTAL CAPITAL COST				**$42,000**	

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
SUBTOTAL				$0	
Allowance for Misc. Items	20%		$0	$0	
SUBTOTAL				$0	
TOTAL ANNUAL O&M COST				**$0**	

PRESENT VALUE ANALYSIS

Discount Rate = 7%

End Year	COST TYPE	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)	PRESENT VALUE	NOTES
0	CAPITAL COST	$42,000	$42,000	1.000	$42,000	
	ANNUAL O&M COST	$0	$0	0.000	$0	
		$42,000			$42,000	
	PRESENT VALUE OF LAND USE CONTROLS COST				$20,000	
	TOTAL PRESENT VALUE OF ALTERNATIVE				$62,000	

SOURCE INFORMATION

1. United States Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).

Alternative: Number 2
Elements: Land Use Controls

COST ESTIMATE SUMMARY

Site: Charleston Naval Complex
Location: AOCs 598 and 599
Phase: Corrective Measures Study
Base Year: 2002
Date: 05/22/03

Description: Implementation of base-wide land use management plan to put institutional controls in place to restrict site use to commercial/industrial.

Assumes this site is part of a multi-site implementation, and costs are shared among all the sites.

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Deed Restrictions - Attorney	4	hour	$200	$800	
Record Deed	4	each	$500	$2,000	
LUC Implementation	24	hours	$75	$1,800	
SUBTOTAL				$4,600	
Contingency	20%		$4,600	$920	
SUBTOTAL				**$5,520**	
Project Management	10%		$5,520	$552	USEPA 2000, p. 5-13, <$100K
Remedial Design	0%		$5,520	$0	Not applicable.
Construction Management	0%		$5,520	$0	Not applicable.
SUBTOTAL				**$552**	
TOTAL CAPITAL COST				**$6,000**	

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Annual Evaluation	12	hour	$75	$900	
SUBTOTAL				$900	
Allowance for Misc. Items	20%		$900	$180	
SUBTOTAL				$1,080	
TOTAL ANNUAL O&M COST				**$1,100**	

PRESENT VALUE ANALYSIS - 20 years

Discount Rate = 7%

End Year	COST TYPE	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)	PRESENT VALUE	NOTES
0	CAPITAL COST	$6,000	$6,000	1.000	$6,000	
30	ANNUAL O&M COST	$33,000	$1,100	12.409	$13,650	
		$39,000			$19,650	
	TOTAL PRESENT VALUE OF ALTERNATIVE				**$20,000**	

SOURCE INFORMATION

1. United States Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).

Alternative: **Subtask** **COST WORKSHEET 1**

Element: **Confirmation Testing**

Site: Charleston Naval Complex **Prepared By:** sn **Checked By:**
Location: AOCs 598 and 599 **Date:** 03/05/03 **Date:**
Phase: Corrective Measures Study
Base Year: 2002

WORK STATEMENT

Costs for soil confirmation sample collection, shipment and analysis on a per event basis.
Total of 17 samples: 1 per excavation wall plus 1 bottom = 5 X3 excavations plus 2 more bottom.

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Equipment & Labor					
Jar Kits	12	EA	$10	$120	CH2M-Jones Est.
Coolers	3	EA	$10	$30	CH2M-Jones Est.
Disposable Gloves	3	BOXES	$20	$60	CH2M-Jones Est.
Collection of samples	8	HR	$68	$544	CH2M-Jones Est.
Sample Shipment	3	EA	$20	$60	CH2M-Jones Est.
Sample Analysis (SVOC)	17	SAMPLE	$95	$1,615	GEL, PEL, STL average
Analysis of data	5	HR	$100	$500	CH2M-Jones Est.
SUBTOTAL				$2,929	
Allowance for Misc. Items	20%		$2,929	$586	
SUBTOTAL				$3,515	
TOTAL COST				**$3,500**	

OPERATION AND MAINTENANCE COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
SUBTOTAL				$0	
Allowance for Misc. Items	20%		$0	$0	
SUBTOTAL				$0	
TOTAL O&M COST				**$0**	

Source of Cost Data

1. Analytical Bid Form - Charleston Naval Complex - Level II

Alternative: 1 **COST WORKSHEET 2**

Element: **Soil Excavation and Disposal**

Site: Charleston Naval Complex
Location: AOCs 598 and 599
Phase: Corrective Measures Study
Base Year: 2002

Prepared By: SN **Date:** 05/22/03
Checked By: **Date:**

WORK STATEMENT

Excavate soil and haul to disposal area; backfill with clean soil and restore surface to original condition.
See quantity calcs

CAPITAL COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Mob/demob/decon	1	EA	$1,000	$1,000	CH2M-Jones Est.
Utility checks and permits	8	HR	$100	$800	CH2M-Jones Est.
Air monitoring and sampling					
Asphalt Pavement cutting	120	LF	$1.15	$138	CH2M-Jones Est.
Asphalt removal	300	SF	$3.15	$945	CH2M-Jones Est.
Excavation (soil) - machine	3	DAYS	$700	$2,100	CH2M-Jones Est.
Asphalt disposal - Non-Haz	24	tons	$45	$1,080	CH2M-Jones Est.
Clean Fill	11.11	CY	$12	$133	CH2M-Jones Est.
Compaction	1	DAY	$100	$100	CH2M-Jones Est.
Replace asphalt	1	TRUCK	$300	$300	CH2M-Jones Est.
Site Operator-Oversight	40	HR	$100	$4,000	CH2M-Jones Est.
Railroad removal/replacement	20	ft	$300	$6,000	CH2M-Jones Est.
Waste characterization TCLP	1	EA	$150	$150	
Waste disposal - Non-Haz	1	ROLLOFF	$600	$600	CH2M-Jones Est.
SUBTOTAL				$17,346	
Allowance for Misc. Items	30%		$17,346	$5,204	20% Scope + 10% Bid
SUBTOTAL				$22,550	
TOTAL UNIT COST				**$23,000**	

OPERATIONS AND MAINTENANCE COST

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
SUBTOTAL				$0	
Allowance for Misc. Items	20%		$0	$0	
SUBTOTAL				$0	
TOTAL ANNUAL O&M COST				**$0**	

Source of Cost Data

1. Means. 2002. Environmental Remediation Cost Data - Assemblies, 8th Edition. R.S. Means Company Kingston, MA.
2. Eden's estimates from AOC 559 CMS cost estimate.

Removal Areas/Volumes

COST WORKSHEET 3

AOC 596 tbw 12/30/2002

Alternative 1

Location	Excavation, ft L	W	D	Surface Area, sf	In Situ Pavement Thickness, ft	Pavement Volume, cy	Soil Volume, cy	
E598SB002	10	10	1	100	1	3.7	3.7	See Note 1.
E598SB006	10	10	1	100	1	3.7	3.7	See Note 1.
E599SB007	10	10	1	100	1	3.7	3.7	See Note 1.
Sum				300 SF	a	11.1	11.1	CY, in situ volume (bank CY)
					b	1.3	1.15	Bulk ratio (load factor)
					c	14.4	12.8	CY, bulk volume
					d	1.6	1.3	Ton ratio
					e	24	17	Tons, bulk weight (rounded)
				CHECK:				
				Typical in situ unit weight		150	110	PCF
				Weight of in situ volume = e/a		160	113	PCF OK

Notes

1 Pavement (thickness assumed).